

Efficacy of 632.8 nm Low Power He Ne Laser in Comprehensive Treatment of Refractive Amblyopia in Children

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Abstract: AIM: To investigate the clinical effect of low power He Ne laser in the treatment of children's refractive amblyopia, and to analyze the necessary reference for the comprehensive treatment of children's refractive amblyopia. METHODS: 112 cases diagnosed (176 eyes) with refractive amblyopia children according to the visiting sequence were randomly divided into treatment group and control group, control group of children with conventional synthetic amblyopia therapeutic apparatus in the treatment, and treatment group attached children helium neon laser project suffering from ocular irradiation treatment, observation of visual function after record 3-6 months, fundus and electrophysiological changes. RESULTS: in the treatment group, the cure rate of mild, moderate and severe amblyopia after 3 months were 82.2%, 80.6%, 36.4%, the cure rate was 95.6%, 88.9%, 63.6% after 6 months. In the control group, the cure rate was 47.7%, 20% and 0% after 3 months, the cure rate was 54.5%, 30%, 12.5% after 6 months, respectively. Statistical analysis showed that the treatment group was better than the control group in the visual function of children with amblyopia ($P<0.05$), and shortened the recovery time of the visual function of the children with amblyopia, and there was no abnormal changes in the fundus of the eyes. Conclusion: low power He Ne laser used in the comprehensive treatment of children with refractive amblyopia, improve the cure rate of amblyopia in children, and shorten the treatment of amblyopia treatment recovery, safe and effective.

Keywords: He Ne Laser, Amblyopia, Comprehensive Treatment

1. Introduction

Refractive amblyopia is more common eye disease in children, due to the visual system development in the critical period into eye visual inadequate caused by monocular stimulation or double with visual development disorder, serious harm to the child's visual health function [1]. Covering method, cam visual stimulation training and fine eyesight training method is usually used in the treatment of amblyopia in children, the longer course of treatment, effect for a long time good [2]. In our hospital from 2013 began using 632.8nm wavelength low power helium neon laser application in the comprehensive treatment of children aged 4-12 refractive amblyopia, and before and after the treatment, the visual

acuity, fundus and electrophysiological changes were observed, statistical analysis comparative refractive amblyopia recovery therapeutic change, from the helium neon laser field and explore the new approach in the treatment of children with ametropic amblyopia. Now reported as follows.

2. Subjects and Methods

2.1. General Information

From diagnosed between June 2013 - June 2015 for children with amblyopia were 173 cases selected 112 cases of refractive amblyopia (176 eyes) aged 4 - 12 years old, the boy in 49 cases (71 eyes), girls in 63 cases (105 eyes), which 92

children with mild amblyopia eyes, moderate amblyopia 67 eyes and 19 eyes with severe amblyopia. Central fixation properties of 137 eyes, 29 eyes of the nature of the next central fixation. According to the visiting sequence random coding and odd and even numbers, which Dan Hao GUI into the treatment group and Shuang Hao GUI as control group, results in the treatment group of 56 cases (94 eyes), which 45 eyes

with mild amblyopia, 36 eyes with moderate amblyopia, severe amblyopia in 11 eyes, center of gaze 76 eyes, paracentral fixation in 18 eyes. In the control group, 56 cases (82 eyes), including 44 eyes with mild amblyopia, 30 eyes with moderate amblyopia, 8 eyes with severe amblyopia, 71 eyes with central fixation and 11 eyes (Table 1).

Table 1. Comparison of general data of two groups of children with amblyopia (eyes).

	Degree of amblyopia			Fixation properties	
	Mild	Moderate	Severe	Central fixation	Side neutral fixation
Treatment group	45	36	11	76	71
Control group	44	30	8	18	11

Degree of amblyopia: 0.45, $P=0.5$; Fixation properties: 1.05, $P=0.3$.

2.2. Examination and Diagnosis

2.2.1. Diagnostic Criteria

Classified according to cause: (1) strabismic amblyopia; (2) of ametropic amblyopia; (3) anisometropic amblyopia; (4) visual form deprivation amblyopia; (5) congenital amblyopia. According to the degree of amblyopia is divided into mild amblyopia (vision 0.8 ~ 0.6), moderate amblyopia (vision 0.5 ~ 0.2), severe amblyopia (visual acuity less than or equal to 0.1).

2.2.2. Examination

All patients diagnosed with refractive amblyopia were routinely examined for near far visual acuity, intraocular pressure, ocular position, ocular refraction, ocular fundus, fixation and eye movement. Were treated with 1% atropine eye gel eye drops, 2 times / D, 3 d after were refractive status of computer examination and retinal ribbon optical retinoscopy, and in 3 weeks after examination, determine the children the best corrected vision glasses degree.

Treatment by medical ethics will pass, and family members of patients signed informed consent, will be incorporated into the standard control group of children with amblyopia, take the following method for synthetic amblyopia treatment: cam visual stimulation, polychromatic light flash treatment, fine eyesight training, intermediate frequency pulse stimulation method, according to the different situation of the amblyopic eye by corresponding covering method, such as covering dominant eye or normal eyes and eyes covered alternately. Treatment of 10 d per course of treatment, the middle of the rest 2 d. Treatment group of children with amblyopia in those

of the control group treatment under additional 632.8nm low power 0.8 1.0mv helium neon laser treatment, laser treatment time source distance eye 2.5m, 1 times / D, each according to 3 - 5 min, 10 days for a course of treatment, interval 2D were under a course of treatment. The course of the two groups were all 3-6 months.

Efficacy evaluation according to the 1996 National Children's strabismus amblyopic treatment study group to develop the standard [3]: (1) is invalid: including visual backward, unchanged or improved from a walker; (2) progress: visual acuity was increased by more than two persons; (3) the basic cure: visual acuity recovered to more than or equal to 0.9 and eyes visual function.

Statistical analysis data using SPSS13.0 statistical software for statistical analysis. Classification data using chi square test, $P<0.05$ for the difference is significant.

3. Results

Mild amblyopia treatment effect is better than that of moderate amblyopia from the degree of amblyopia, moderate amblyopia therapeutic effect was better than that of severe amblyopia treatment group was better than that of the control group (Table 2 and table 3); from watching the view of the nature of the central fixation therapy effect is better than the paracentral fixation (Table 4). During the treatment of each patient formulated strict referral arrangements, and regularly check the changes of vision and fundus, excluding the outer eye and ocular fundus diseases and other adverse factors interfere with treatment effects.

Table 2. Compared to 3 months after the effect of two groups of children with amblyopia (eyes).

	Treatment group			Control group		
	Mild	Moderate	Severe	Mild	Moderate	Severe
Basic cure	37 (82.2%)	29 (80.6%)	4 (36.4%)	21 (47.7%)	6 (20.0%)	0 (0%)
Improve	8 (17.8%)	5 (13.9%)	5 (45.5%)	13 (29.5%)	11 (36.7%)	3 (37.5%)
Invalid	0 (0%)	2 (5.5%)	2 (18.1%)	10 (22.8%)	13 (43.3%)	5 (62.5%)

$\chi^2=38.13$, $P<0.01$.

Table 3. Compared to 6 months after the effect of two groups of children with amblyopia (eyes).

	Treatment group			Control group		
	Mild	Moderate	Severe	Mild	Moderate	Severe
Basic cure	43 (95.6%)	32 (88.9%)	7 (63.6%)	24 (54.5%)	9 (30.0%)	1 (12.5%)

	Treatment group			Control group		
	Mild	Moderate	Severe	Mild	Moderate	Severe
improve	2 (4.4%)	3 (8.3%)	3 (27.3%)	11 (25.0%)	13 (43.3%)	4 (50.0%)
invalid	0 (0%)	1 (2.8%)	1 (9.1%)	9 (20.5%)	8 (26.7%)	3 (37.5%)

$\chi^2=42.0$, $P<0.01$.

Table 4. Relationship between fixation and therapeutic effect of two groups of amblyopia after 6 months (eyes).

	Central fixation		Side neutral fixation	
	Treatment group	Control group	Treatment group	Control group
Basic cure	71 (93.4%)	32 (45.1%)	11 (68.8%)	2 (18.2%)
improve	5 (6.6%)	27 (38.0%)	3 (18.8%)	1 (9.1%)
invalid	0 (0%)	12 (16.9%)	2 (12.4%)	8 (72.7%)

Central fixation: $\chi^2=38.9$, $P<0.01$; Side neutral fixation: $\chi^2=9.18$, $P<0.05$.

4. Discussion

Amblyopia is clinical ophthalmology common eye disease in children and babies and infants time, due to various reasons such as perception, motion, conduction and visual center reasons not to accept suitable visual stimulation, so that the visual development affected by the occurrence of visual function decline, mainly for low vision and binocular single vision dysfunction. The latest statistics show that the prevalence rate has increased more than 3% [4]. Foreign reports in the general population, the incidence of amblyopia 2-2.5% [5]. In recent years, the research of domestic and foreign scholars on the mechanism of amblyopia have great progress, there is a consensus that amblyopia is a from retinal ganglion cells begin to visual center visual transmission system and central areas of functional and morphological abnormalities, produce the factors of amblyopia visual deprivation and binocular interaction and cerebral cortex of active suppression [6]. Amblyopia in the visual development period can occur, more than 1 to 2 years old, the onset of amblyopia earlier, the more severe the degree [7]. Most scholars believe that the plasticity of the visual nervous system from 4 to 5 years old is relatively strong, and after several years to stabilize, so this stage is the key period of treatment of amblyopia, timely treatment can obtain satisfactory curative effect [8]. We know that good eyesight is not acquired by birth, the baby is born, the vision is less than 1% of the adult, with the age of growth, the continuous development and improvement of the eyes of the cells. 5 years old is within the visual function to the development of an important period, visual development continues to 6 ~ 8 years old, such as for some reason this period caused by binocular visual obstacle, visual cell is not normal stimulation, visual function stays in a lower level, binocular vision is low, cannot be rectified, formed the binocular amblyopia; if can only use one eye to see, as time passes repeated stimulation of visual development, and can't look in the other eye growth retardation, formed of monocular amblyopia. And after the end of the 9 year old visual development sensitive period, the hope of a cure for amblyopia [9]. With the increasing of the population of our country and the development of medical technology, more and more children with amblyopia will be diagnosed, the key to the treatment of amblyopia is early detection, early treatment.

He Ne laser is the first gas laser which was successfully

operated in 1961. Is to work in the four level mode, the laser is a neon atom, helium atoms only to absorb the energy of resonance transfer to the neon atoms, played a good role in the media. Helium neon laser by laser discharge tube, resonance cavity and an excitation power supply composed of three parts, in the medical helium neon laser is mainly used for irradiation, stimulation, anti-inflammatory, analgesic and vasodilation. Such as the Department of internal medicine can be used for acupuncture point irradiation, body surface local irradiation; Department of Dermatology for the treatment of skin, mucosal ulcers, etc.. The characteristics of He Ne laser has the following organizations: (1) low dose irradiation can play a stimulating effect, irradiated tissue protein synthesis to accelerate glycogen content increased, RNA activity strengthened; while high dose inhibition appeared; (2) cumulative effect, biological effect of multiple low dose irradiation and is equal to a the dose of irradiation generated; (3) a parabola, the irradiation dose unchanged, body reaction gradually strengthened in third and 4 days, generally in 1-15 d reached the peak, and then it decreased gradually, if continuous irradiation can be inhibited; (4) diffusion the effect of the spot is small, the effect of a role, must not only be limited to spot site [10].

Low power He Ne laser treatment of amblyopia is to use the laser to illuminate the fundus, stimulate and activate the macular development lag of the visual function of cells. He Ne laser irradiation can make blood can promote vascular spasm and anti coagulation effect of substance concentration decreased, blood viscosity and hematocrit decreased significantly, improve red blood cells carrying oxygen ability, so as to improve local microcirculation, promoting cell developmental changes in [11]. Treatment and observation results show that, compared with the commonly used visual enhancement therapy, grating, red light flicker, fine work, and treatment of amblyopia, He Ne laser combined with the treatment effect is more satisfactory. In the control group 3-6 months later used alone amblyopia therapeutic apparatus in the treatment of light, and severe amblyopia children 3 months after cure rate was 47.7%, 20.0%, 0%, 6 months after the cure rate was 54.5%, 30.0% and 12.5%. Treatment group combined with he - Ne laser treatment, in the treatment of mild and severe amblyopia children 3 months after cure rate is 82.2%, 80.6%, 36.4%, 6 months after the cure rate of 95.6%, 88.9%,

63.6%, indicating that He Ne laser in the treatment of amblyopia can significantly improve the cure rate. In different degree of amblyopia, amblyopia more light, better therapeutic effect, rapid recovery, that the degree of amblyopia more mild visual cell growth inhibition degree of light, easy to recover. The effective results of low power He Ne laser in the treatment of amblyopia have been reported in our clinic, which is consistent with the report of the domestic and foreign scholars [12]. About the safety dose of He Ne laser treatment of amblyopia, that is, the intensity of irradiation, irradiation frequency, irradiation time, the length of the course of treatment and other visual cells are inhibited and damage, it is not clear [13, 14]. Compared with the commonly used visual therapy, grating, red light flicker, fine work, and treatment of amblyopia, He Ne laser combined with comprehensive therapeutic instrument is more satisfied. Some studies suggest that Ne laser of red light on pyramidal cells is very sensitive, have a high absorption rate, because of its stimulation effect on living tissue, activate and strengthen the pyramidal cells of photoreceptor function, on retinal thermal effect and biochemical effects, the retinal and choroidal blood vessels dilate blood circulation to improve. Because it can regulate the function of nerve conduction and nerve reflex, it can dredge the visual pathway of the retina to the cerebral cortex, activate the optic path and improve the afferent function of the light image. Clinical observation showed that the He Ne laser in a certain dose to the eye refractive medium, such as the cornea, lens, vitreous and iris, choroid without any damage only a few children at the time of irradiation appear dazzling, tears, slight stinging reactions, but a few minutes disappeared, does not affect the treatment [15]. The application of He Ne laser in the comprehensive treatment of refractive amblyopia in children is rarely reported in China. At present, there is still a lack of systematic research. Therefore, it is worthy of further research in clinical treatment of amblyopia.

5. Conclusion

Low power He Ne laser used in the comprehensive treatment of children with refractive amblyopia, improve the cure rate of amblyopia in children, and shorten the treatment of amblyopia treatment recovery, safe and effective.

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